HISTORY

COLLEGE OF MEDICINE

1959-1968

CHAPTER 17

DEPARTMENT OF PHYSIOLOGY

F.A. HITCHCOCK, PH.D.

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I. Introduction

An account of the founding and early history of the Department of Physiology is to be found in the two volumes of historical data entitled "The Ohio State University College of Medicine:" (volume I published in 1934 and volume II in 1958). The present account will, therefore, be concerned chiefly with the happenings in the department since 1958.

Dr. Eric Ogden, who had been appointed Chairman of the department in 1949 was in charge of the Department during the first few years of this period. He was a Cardiovascular physiologist who had been trained in England and had been much influenced by the distinguished Professor of Physiology at the University of London, Dr. Ernest Henry Starling. In 1955 Dr. Ogden brought Dr. Gerhard A. Brecher to Ohio State as a Research Professor. Dr. Brecher's field was the physiology of vision and he had joint appointments in the departments of Physiology and Opthalmology. Dr. Brecher was at Ohio State for only two years. He left in 1957 to accept the position of Chairman of the Department of Physiology at the Emory University School of Medicine in Atlanta, Georgia. He did, however, have a considerable effect on the department indirectly, for in 1957 he met in Germany Dr. Heinz Pieper who at that time was Assistant Professor of Physiology at the University of Munich, and persuaded him to come to Ohio State as a Research Associate. When Dr. Brecher left for Georgia he tried to persuade Dr. Pieper to go with him, but fortunately for the department Dr. Pieper elected to stay here. Almost at once Dr. Ogden made him an Assistant Professor. In 1960 he was promoted to Associate Professor and in 1968 to full Professor. Since joining the department Dr. Pieper has been a very productive research worker in the cardiovascular field.

During the past ten years he has published more then a dozen major papers. In 1962 he was appointed Established Investigator of the American Heart Association and in 1968 he was made a member of the Physiology Study Section of the National Institutes of Health.

II. The Faculty of the Department in 1958

In 1958, when the College of Medicine celebrated the 125th anniversary of its founding, the personnel of the teaching and research staff was as follows:

1) Eric Ogden, Professor and Chairman of the Department since 1949. He is an investigator in the cardiovascular field of international renown; 2) Clifford Angerer, who was promoted to the rank of Professor in 1954. He has been a member of the Physiology Department for about thirty years and during that time has more than fifty papers on his research which lies in the field of cellular and comparative physiology; 3) Emil Bozler who received his Ph.D. degree from the University of Munich in 1923 and joined the Ohio State University Department of Physiology in 1936. He was promoted to the rank of Professor in 1945. His field of specialization is the physiology of smooth muscle and he has published the results of his research in more than seventy papers. He has an international reputation in this field. In 1958 he received a Fulbright Award and was a Guest Professor at the University of Heidelberg in Germany. In 1963 he was elected an Honorary Member of the German Physiological Society. In 1961 he was invited to give lectures on his speciality at a number of Japanese institutions and he was invited to make a similar tour of universities in Great Britain in 1962; 4) Robert C. Grubbs has been a member of the Physiology Department since 1946 and was promoted to Professor in 1957. In 1956 Dr. Ogden asked him to serve as Vice Chairman and since that time he has been chiefly occupied with Teaching and Administration, but in spite of his burden of duties in

these fields he has found time to do important research in the field of metabolism. He has published papers on the metabolic effects of folic acid in human subjects and the effects of ionizing radiation on nucleated erythrocytes. He has also investigated the effects of various oral hypoglycenic agents on tissue metabolism; 5) Fred A. Hitchcock has been a member of the department since 1923. In 1940 he organized the Laboratory of Aviation Physiology (now known as the Laboratory of Environmental Physiology) and was its director until his retirement in 1960. He was acting Chairman of the Department from 1947-49. Details of his career since 1958 are given in a later part of this history; 6) Leo Sapirstein, a brilliant young investigator in the field of cardiovascular physiology, was brought to the Department as Assistant Professor by Dr. Ogden from the University of California in 1951. He was made Associate Professor in 1953 and advanced to Professor in 1955. In 1962 he was given a leave of absence to accept a temporary post at Stanford University. This leave of absence was renewed in 1963 and in 1964. In 1965 he resigned to accept a permanent position at Stanford; 7) Ralph Stacy, who received his Ph.D. from Ohio State in 1948 and had been on the staff of the Physiology Department since 1949, began in 1950 to develop the field of biophysics. He was unusually successful in this effort and he and his colleagues published more than forty papers in this field. In 1957 he took the initiative in the founding of the Biophysical Society and afterward served as an officer of this organization for a number of years. In 1959 he was advanced to the rank of Professor. He resigned in 1962 to accept a Professorship at the University of North Carolina; 9) Katherine Brownell came to the Physiology Department in 1934 as a Research Assistant and in 1940 she was awarded the Ph.D. degree. In 1946 she was promoted to Instructor. She was made an Assistant Professor

in 1953 and was raised to the rank of Associate Professor in 1960. Her research interests are in the field of the Adrenal, particularly chemical and metabolic effects of adrenal steroids and the relation of the adrenal to hypertension; 9) Norman Coulter who earned the M.D. degree at Harvard Medical School in 1950 came to Ohio State in the Autumn of 1952 as an Assistant Professor. He worked with Dr. Stacy in developing the field of biophysics and shortly after Dr. Stacy left for the University of North Carolina Coulter joined him there where they are both continuing their research in various aspects of biophysics; 10) Milton Lessler was appointed Assistant Professor of Physiology in 1951. He had taken a Masters degree at Cornell in 1938 and a Ph.D. at New York University in 1950. He had served in the U.S. Army 1942-45 and after being discharged spent four years as a research assistant and teaching fellow at New York University; 11) Larissa Lukins who had degrees from Katowice College in Poland and Heidelberg University in Germany as well as the Ph.D. from Columbia was appointed an Assistant Professor in 1957. Her research was in the field of respiratory metabolism. She resigned in 1963; 12) Margaret Nishikawara who has the B.A., M.A., and Ph.D. degrees all from the University of Toronto was appointed Assistant Professor in 1954 and promoted to the rank of Associate Professor in 1963. Her research is in the field of endocrinology.

It has been the policy of the Department for many years to have on its staff for part time service members of other closely related departments. The staff members holding such joint appointments are men who have a special interest in physiology. In 1958 such appointments were held by; 1) Morgan Allison, who is now chairman of the Department of Oral Surgery

in the College of Dentistry; 2) Floyd Beman, Professor of Medicine whose special interest is in the physiology of the gastro-intestinal tract; 3) Earl Carter who also served in the Department of Preventive Medicine and who was a specialist in Aviation Physiology; 4) Leo Lipetz of the Department of Opthalmology. Dr. Lipetz has recently been appointed professor in the newly organized Department of Biophysics; 5) William G. Myers, a radio-biologist who holds the rank of Professor in the Department of Radiology; 6) Richard Stow, an Associate Professor of Physical Medicine; and 7) Joseph Tomashefski who was brought to Ohio State as director of research in the Tuberculosis Hospital.

All of these men still hold such joint appointments in physiology with the exceptions of Drs. Carter and Tomashefski. Dr. Carter resigned a number of years ago to accept a post on the staff of the Mayo Foundation in Rochester, Minnesota. Dr. Tomashefski recently resigned to join the staff of the Battelle Memorial Institute.

III. Changes in the Faculty since 1958

Since 1958 two additional men have been appointed to such part time posts in Physiology. These are Dr. Charles E. Billings, Associate Professor in Preventive Medicine, also a specialist in Aviation Medicine, and Professor Donald K. Mathews of the Department of Physical Education. Dr. Mathews was brought to Ohio State to organize and direct a research laboratory in Physical Education. The research carried out in this laboratory has from the first been concerned with the physiological aspects of physical education and as a result of this interest several graduate students in physical education have taken advanced degrees in physiology.

During the final years of Dr. Ogden's tenure as Chairman there were only a few changes in the staff. One major change, however, did occur in June of 1960 when Professor F.A. Hitchcock, who had been on the staff of the Physiology Department since 1923, and had been Director of the Laboratory of Aviation Medicine since its inception in 1941 reached the retirement age. During this time he had received many honors. Fellowships have been conferred on him by the American Association for the Advancement of Science, the American Astronautical Society and the Aerospace Medical Association. In 1957 he served as President of the Space Medicine branch of this group. In 1955 he was the recipient of the Tuttle award in recognition of his outstanding research in Aviation Medicine and in 1957 he was elected a life member of the Scientific Council of the Brazilian Interplanetary Society. He was a member of some nine international congresses in physiology and astronautics in seven different countries. In 1956 he was selected as one of four American scientists to visit physiological research laboratories in Russia.

After his retirment he served for a year as Educational Director of the American Institute of Biological Sciences in Washington D.C., and in 1963 he was appointed Adjunct Professor of Physiology at the University of Pennsylvania and sent to Shiraz Iran as visiting Professor. He served in this capacity until August of 1964. On his return to Columbus he was awarded the Ohio State University Distinguished Service Medal.

To replace Dr. Hitchcock Dr. Edwin P. Hiatt was appointed Professor and Director of the Laboratory of Aviation Physiology (it is now known as the Laboratory of Environmental Physiology). Dr. Hiatt had already had a distinguished career in this field having served for fourteen years at Wright-Patterson Air Force Base first as chief of the Acceleration Section and later as chief of the Biophysics branch.

In 1961 Dr. Stacy who had been promoted to the rank of Professor in 1959, resigned to accept a Professorship at the University of North Carolina. Incidentally the salary paid him at North Carolina was just twice what he had been receiving here at Ohio State. A year later Dr. Norman Coulter resigned to join Dr. Stacy in North Carolina. Dr. Stacy had been disappointed in the cooperation he had received from the administration in his efforts to develop the field of biophysics. Shortly after this the department of Biophysics was established and since then there has been no activity in this field in the Physiology Department, although much of the research done might rightly be classified as biophysics.

In 1962 Dr. Eric Ogden, after serving for 13 years as Chairman of the Department resigned to accept the position of chief of the Environmental Biology division at the Ames Research Center in California. At once a committee was appointed to search the country for just the right man to

take over the chairmanship of the department. This search lasted for two years and during this time Dr. Robert C. Grubbs was asked to take over the administrative responsibilities of the department. Dr. Grubbs was, of course, well fitted for this position since he had acted as Vice Chairman during most of Dr. Ogden's tenure.

Dr. Grubbs made few changes in the Department during his brief tenure, but in 1963 he brought Dr. Thomas B. Calhoon into the department as Associate Professor. Dr. Calhoon was an outstanding member of the department. In 1966 he received the Alumni Award for distinguished teaching and in 1967 he was promoted to Professor. The same year he resigned to accept the chairmanship of the Department of Physiology at the University of Louisville.

Another addition to the staff during this period was Dr. Joseph A. Lipsky who had received his Ph.D. from Ohio State in 1961. Shortly after this he was appointed Assistant Professor in the Department. His chief teaching responsibility has been the course for dental students. He was promoted to Associate Professor in 1967. He holds a joint appointment in the College of Dentistry.

At last the committee on the selection of a new chairman reached a decision and in April 1964 Dr. Robert C. Little was brought here to begin his service as Chairman. Dr. Little, who like Dr. Ogden, is a cardiovascular physiologist had taken his M.D. at Western Reserve University in 1944 and then served as a Captain in the Army Medical Corps (1945-47). He was appointed a Post Doctoral Fellow with Dr. C.J. Wiggers in 1947 and continued in this capacity until 1949. After holding a variety of academic and research positions he was appointed Professor of Physiology at Seton Hall College of Medicine and Dentistry in 1958. He held this position until coming to Ohio State in 1964.

Under Dr. Little's direction the Department of Physiology has expanded rapidly. The full time active members of the Department with the rank of Assistant Professor and above now number 21 as against 16 in 1958. The chief additions to the Department are as follows: 1) Dr. Harold Weiss who originally came to Ohio State as a Research Associate to assist Dr. Hiatt in the laboratory of Environmental Physiology was advanced to the full time faculty and raised to the rank of Professor in 1967; 2) Dr. Charles W. Smith joined the staff in 1964 as an Associate Professor and was promoted to Professor in 1969. He holds both the Masters and Ph.D. degrees from the University of Michigan and has been on the teaching staff at the University of Michigan and Seton Hall College of Medicine.

Dr. Stephen LeBrie was appointed Associate Professor in 1966. He holds both the M.S. and Ph.D. degrees from Princeton University. He came to Ohio State from Tulane University School of Medicine. Ten Assistant Professors have joined the department since 1962. These are Albert L. Kunz (1962), Lawrence T. Paul, E. Keith Michal and James A. Grossie all in 1965, Kenneth M. Hanson (1966), Richard L. Clancy and Chester E. Hendrich in 1967 and Marjorie F. Sparkman in 1968. Biographical data on all of these persons will be found in the final section of this history.

IV. Teaching Programs

As has already been pointed out the Department of Physiology is a University department although for administrative purposes it is located in the College of Medicine. This means, of course, that all courses in animal physiology regardless of the college involved are taught by this department. (It should be noted, however, that the single exception to this rule is in Veterinary Physiology, which is taught in the College of Veterinary Medicine. This separation was originally the result of the complaint on the part of students in Veterinary Medicine that in the course offered in this department they were taught only human physiology. This complaint is, interestingly enough, in direct conflict with the complaint frequently made by the medical student that they are taught only frog and dog physiology). As a result of this arrangement some twelve or thirteen separate courses are taught in the department about half of them having little or no connection to the College of Medicine. These include courses for students majoring in Physical Education, Home economics, education, arts and sciences and branches in biological sciences other than physiology.

The recent organization of the College of Biological Sciences will undoubtedly have a marked effect on the number of courses offered by the Department since it is to remain in the College of Medicine. According to an agreement with the College of Biological Sciences in the future the Department of Physiology will limit its undergraduate teaching to students in the School of Nursing, School of Allied Medical Professions, and the College of Pharmacy. As a result some of the undergraduate courses have been taken over by the College of Biological Sciences.

During the final years of Dr. Ogden's tenure as Chairman of the department the teaching of elementary undergraduate courses was rotated among the junior members of the department. This policy gave these younger members of the department varied experience in teaching and also made it possible for them to keep in touch with the important research developments in the broad field of physiology. On the other hand professional and graduate courses were taught exclusively by experts. That is to say the senior members of the department lectured to the students in these courses on their specialties, and were responsible only for that portion of the course upon which they had lectured.

When Dr. Little became Chairman of the department in 1964 he undertook a comprehensive study of the undergraduate teaching committments of the department. As a result of this study there was a reorganization of the undergraduate program into two levels of instruction. An introductory sequence designed for general college students was started together with an intermediate level course for professional and other students who had a need for a more substantial course. A senior faculty member was assigned the responsibility for each of these courses on a rotational basis with the help of several junior faculty members.

The instruction of professional and graduate students under this regime is carried out by a team of faculty members. The lectures are divided so that each individual covers the area of his research competence. Each member of the team is in charge of some twenty students for both conferences and laboratory work. The emphasis was changed from the older idea of only student participation to a team effort, where the instructor and the students work together to gather and interpret physiological data. A number of

demonstration experiments utilizing sophisticated equipment were also introduced. These experiments make use of closed circuit television to give each student a close view. However, the experiment is carried out in the presence of the class and the television screen is used only so that all can see the details of the experiment.

The graduate students take the same course as the Medical students but under a different course number, and are required to do additional laboratory experiments in which the students themselves carry out the experimental procedures. Since Dr. Little has been here the laboratory apparatus has been modernized and now all recording is done electronically.

The department has a Graduate Committee consisting of six senior members of the department. This committee passes on the admission of graduate students and keeps a friendly eye on the quality of their work. The Committee also passes on the acceptability of the thesis and dissertation subjects. Two members of this committee are appointed each year by the chairman of the department and the committee chooses its own chairman.

Since 1964 the department has awarded fifteen Masters degrees and six Ph.D.'s. At the end of the1967-68 academic year there were twenty-nine graduate students enrolled in the department. Fourteen of these were candidates for the Ph.D. degree and the remainder were working toward a Masters degree.

There follows in Table 1 a listing of all Ph.D. degrees awarded in physiology with the year and dissertation title. A similar list of Masters degrees is given in Table 2. Since such data were not included in historical material previously published both tables go back to 1924, the year in which graduate degrees in physiology were first granted.

V. Research

The research activities of the department are extensive, thorough and diversified. Almost every aspect of Physiological Science is being investigated by one or more members of the faculty. During the academic year 1967-68 some thirty-six separate research projects were under investigation by about twenty members of the faculty. The high quality of this research is indicated by the fact that these thirty-six research projects were supported financially by thirty-eight grants from various foundations, institutes and other fund granting organizations. The total dollar value of this support was nearly a quarter of a million dollars. Some fifteen papers resulting from this research were published during the year in scientific journals.

Perhaps the field being investigated most actively by the members of the department is cardio-vascular physiology

Among the many cardiovascular problems being investigated by members of the staff may be mentioned Dr. Little's study of stress relaxation and myocardial contraction; Dr. Heinz Pieper's investigation of myocardial heat production as a measure of cardiac efficiency and Dr. Bozler's research on the physico-chemical aspects of cardiac muscle. Among the various other aspects of cardiovascular physiology being investigated are metabolic studies on arteries, blood cells and cardiac muscle, the autoregulation of regional blood flow, and the effect of hypocapnia on cardiac performance.

The most ambitious and comprehensive research program under investigation in the Physiology Department is a cooperative project which bears the all inclusive title of "The Biology of the Heart." This project is a joint effort of the Colleges of Medicine and Veterinary Medicine. The cooperative

nature of the project involves a number of departments among which may be mentioned Pathology, and Physiology. Work already underway includes studies on 1) the reaction of heart muscle to injury, 2) biochemical control of energy release in the myocardium, 3) electrical events of the heart, 4) mechanical events of the heart and 5) cardiovascular pharmacology. The National Institute of Health is supporting the project with grants which total more than two and a quarter million dollars to be used over a seven year period

Another field in which the department has carried on a very active research program is that of environmental physiology. Work in this field was started back in 1941 when Professor Fred Hitchcock organized the Laboratory of Aviation Physiology. Shortly after getting started the laboratory was asked by the Office of Scientific Research and Development to devote all of its resources to a comprehensive investigation of the physiological and pathological effects of rapid decompression. This work continued for more than ten years and resulted in the publication of some thirty papers. After the war, the laboratory was supported by contracts with the Office of Naval Research, the Aero Medical Laboratory at Wright-Patterson Air Force Base and the National Safety Council. Under the sponsorship of one or more of these sources of funds the laboratory carried out a study of the second to second changes in O_2 and CO_2 content of expired air as measured by a specially designed mass spectroscope built in the laboratory under the direction of Dr. Ralph Stacy. Other investigations carried out included tests to evaluate the efficiency of the partial pressure suit, the physiological and pathological effects of rapid deceleration by so-called safety belts, the effect of moderate amounts of alcohol on the susceptibility to hypoxia and finally the physiological effects of artificial atmospheres of various compositions. This project has been supported by the National Astronautical and Space Agency and various aspects of the study are still under investigation.

In 1949 Dr. Hitchcock accepted, on a part-time basis a position as Consultant to the Civil Aeronautics Administration. In this capacity he was able to organize and carry out an extensive study of the energy cost of flying multi engine aircraft using as subjects C.A.A. agents and Commerical airline pilots. This was a joint project of the Ohio State University and the Civil Aeronautics Administration and is another example of the type of cooperative research that the Physiology Department has carried on with various departments of the University as well as outside organizations.

Further examples of cooperative research engaged in by the Physiology Department are the investigation carried on jointly with the Departments of Preventive Medicine and Physical Education. There has been cordial cooperation between Physiology and Preventive Medicine ever since Professor William Ashe became Chairman of the latter department in 1954. Shortly after Dr. Ashe assumed this position he was successful in obtaining a substantial grant from the National Institutesof Health for the purpose of undertaking a large scale study of the effects of vibration. Since at that time Preventive Medicine had been assigned no research space and such space was decidedly in short supply an agreement was reached between Dr. Hitchcock, director of the Laboratory of Aviation Physiology and Dr. Ashe so that Preventive Medicine's Vibration Laboratory could be set up in space assigned to Aviation Physiology. Naturally, sharing of space in this way resulted in close cooperation in the research projects being investigated and in several cases even in the sharing of personnel.

A similar situation exists between the Physiology Department and the Men's division of the Department of Physical Education. Dr. Hitchcock had for years been interested in the physiology of muscular exercise and had for

some time been urging the Department of Physical Education to set up a laboratory for the study of physiological problems connected with physical education. These efforts were, however, unsuccessful until in 1958 Dr. Don Mathews, a student of Dr. Peter Karpovitch, was hired by Physical Education for the express purpose of starting a research program in that department. Naturally there was some delay in getting a suitable laboratory equipped for Dr. Mathews and during this time he spent much of his time helping out in the Laboratory of Environmental Physiology. Thus the pattern of cooperation was established early and has continued to the benefit of both Physiology and Physical Education.

The Laboratory of Aviation Physiology is now known as the Laboratory of Environmental Physiology and its research now under the direction of Dr. Edwin Hiatt with the assistance of Dr. Harold Weiss is centered around the study of artificial atmospheres made up of various combinations of such rare gases as helium, argon and neon with various amounts of oxygen both with and without small amounts of nitrogen added. Such atmospheres are being tested on birds and small mammals. The effect on respiration and on cardiac and vascular changes are being noted. The effects on developing chicken embryos have been studied and recently in connection with the department of Microbiology possible changes in susceptivity to disease are under investigation. Possible changes in the endocrine system are also about to be investigated.

There are also a variety of other research projects underway. Among these are endocrine studies such as the role of thyroid and parathyroid hormones in reproductive processes which is being investigated by Dr. Hendrichs and the control of the adrenal cortex in the opossum which is being studied by Dr. Brownell. Dr. Nishikawara is carrying on an investigation of the

physiologic factors affecting glutamic dehydrogenase, and Dr. Grossie is engaged in research on the influence of adrenal homrones on muscle receptors.

Among other research in progress may be mentioned studies of atherosclerosis by Dr. Weiss, a study of renal lymph and renal function by Dr. LeBrie and the determination of blood cell metabolism by Dr. Lessler.

Research grants over the decade are listed in Table 3; publications by years are in Table 4.

Table 1

DOCTOR OF PHILOSOPHY DEGREE

Year	Name	Thesis Title
1924	Tuttle, Waid W.	Quantitative Study of the Patellar Reflex
1925	Caskey, Marion W.	Calorigenic Effect of Adrenalin
1926	Hitchcock, Fred A.	Studies on Vigor and Growth of the White Rat
1926	Lee, Milton O.	Studies on the Oestrous Cycle in the White Rat
1927	Durrant, Rollin R.	Studies on Blood Pressure
1927	Durrant, Edwin P.	Endocrine Studies on the White Rat
1928	Schear, Edward W.	The Content of Sugar in the Blood of Mus Norwegicus Albinus when Subjected to Low Temperature
1931	Kraft, Ruth M.	The Effect of Pituitary Hormones on the Activity and Ovulation of Young Female Albino Rats
1932	Ashcraft, Derwin W.	The Effects of Feeding Varied Rations Upon the Hydrogen Ions Concentration of the Intestinal Contents of Domestic Fowl
1932	Elhardt, Walter P.	The Effects of Methyl, Ethyl, Propyl, and Butyl Alcohols on the Growth of White Leghorn Chickens
1934	Katz, Harry L.	Chemical, Cytological and Physical Changes in the Blood during Emotional Excitement
1934	McNelly, Walter C.	Some Effects of Training on the Muscular Mechanical Efficiency of the Human Body
1940	Brownell, Katherine A.	Influence of Adrenal Preparations on Basal Metabolism and the Specific Dynamic Action of the Three Major Foodstuffs
1940	Lewis, Lena A.	The Refractory State Developed Following Repeated Injection of Adrenal Extract

DOCTOR OF PHILOSOPHY (continued)

Year	Name	Thesis Title
1940	Spoor, Herbert J.	Cortin and the Sodium Factor of the Adrenal
1944	Thatcher, Jonathan S.	Sodium Retaining Substances of the Adrenal Gland
1945	Smith, Douglas E.	Adrenal Function Following Ovariestomy in the Rat
1947	Edelmann, Abraham	The Effects of Exposure of Dogs and Rats to a Total Barometric Pressure of Thirty Millimeters of Mercury
1948	Stacy, Ralph W.	Studies of the Dynamic Behavior of Lung Gases and of Gas Tensions of Alveolar Air Following Sudden Changes in Partial Pressure of Oxygen in Inspired Air
1948	Greenberg, Riven	Variation of Choline Acetylase Content of Brain in Stressed and Unstressed Normal and Adrenalectomized Rats
1949	Joffe, Milton H.	Anatomical and Physiological Factors Involved in the Tolerance to Rapid Deceleration
1952	Angelone, Luis	Studies on the Oxygen Consumption of Nonnucleated Erythrocytes
1952	Calhoon, Thomas B.	Adrenal Cortical Extract and Carrying Agents on the Metabolism of Poikilotherms
1953	Vail, Edwin G.	Dynamic Responses within the Thorax to Explosive Decompression
1953	Fasola, Alfred F.	Anatomical and Physiological Effects of Rapid Deceleration
1953	Williams, Martin W.	Oxygen Consumption of Adrenal and Thyroid Glands of Testectomized Rats in the Presence of Various Metabolic Substrates
1953	Farzeneh, Tamaddon	Endocrine Factors Influencing Impedance and Impedance Angle in Albino Rats
1953	Kornfield, Alfred T.	Studies of the Behavior of Completely Isolated Mammalian Kidneys Perfused with Blood in an Entirely Mechanical Circuit; Renal Vascular Pressure-Flow Relation

DOCTOR OF PHILOSOPHY DEGREE (continued)

Year	Name	Thesis Title
1954	Liu, Tsung Yuan	A Study of the Changes in Responsiveness of the Uterus of the Castrated Rat to Estrogenic Hormones in Relation to Age
1954	DeFeo, Vincent J.	Factors Influencing the Development of Deciduomata in Puberal and Adult Rats
1955	Kydd, George H.	Respiratory and Circulatory Responses of Animals during the Administration of Continuous Positive Intrapulmonic Pressure
1955	Randall, James E.	Pulsatile Relationship between Blood Pressure and Blood Flow in the Hind Limb of the Dog
1955	Rothe, Carl F.	Studies on the Renal Glomerulo-Tubular Relationships as Revealed by the Effects of Ureteral Pressure on the Excretion of Magnesium, Calcium, and other Electrolytes, with Appendices on the Flame Spectrophotometric Determination of Magnesium and Calcium
1955	Wortman, Bernard	Lipidosis on the Oxidative Metabolism of Rat and Rabbit Ventricular Slices
1955	Zatzman, Marvin L.	A Kinetic Basis of Time-dependent Properties of Arterial Smooth Muscle
1955	Gass, George H.	Endogenous and Exogenous Metabolism of Adrenal, Pituitary and Thyroid Tissues of Male Rats Following Prolonged Treatment with Testosterone Propionate
1956	Fukuyama, George S.	The Relationship of Body Water Variation to the Whole Body Impedance in the Dog
1957	Baker, Saul P.	Immunophysiology of Serum Lipoproteins Associated with Atherosclerosis
1957	Eberstein, Arthur	Correlation of Birefringence and Mechanical Properties of Living Smooth Muscle
1957	Reininger, Edward J.	The Effect of Fading on Splanchnic and Regional Blood Flow
1957	Koulish, Sashi	Cytophysiological Aspects of Normal and Tumorous Liver

DOCTOR OF PHILOSOPHY DEGREE (continued)

Year	Name	Thesis Title
1958	Farrow, Robert L.	An Analysis of Pressure Energy Hormonic Propagation in the Arterial System by a Digital Computer Fourier Technique
1958	Hennacy, Richard A.	Cardiac Impedance: Factors Affecting the Resistance of the Heart to Filling
1959	Keating, Frederick M.	A Study of the Cardiovascular Dynamics in the Dog Infused with Large Doses of Epinephrine and Norepinephrine
1959	Constantine, Jay W.	Dietary Cholesterol on Free and Bound Cholesterol and Lipid-Phosphorus Content of Rabbit and Rat Aorta, Heart Muscle, Plasma and Adrenal
1959	Thiede, Frederick C.	Pulmonary and Cardiovascular Response Mechanisms in Dogs during Inhalation of Low Concentrations of Carbon Monoxide
1960	Coburn, Kenneth R.	The Cardiovascular and Respiratory Response of Dogs to Lethal Concentrations of Carbon Monoxide
1960	Ezrow, Leonard	Excretion of Sodium and Water in Rats Made Hypertensive by Subtotal Nephrectomy
1960	Leverett, Sidney D.	The Correlation of Pressure and Flow in the Arterial System of Intact, Anesthetized Dogs and its Changes Under the Effect of Vasomotor Activity
1961	Besch, Paige K.	Adrenocortical Steroid Profile in the Hypertensive Dog
1961	Hamre, Harold T.	Effect of Fatal Hypoxia on Large Vessel Hematocrit, Plasma Protein Concentrating and Plasma Osmolarity: Experimental Approach to the Subject of Extra Plasma
1961	Lipsky, Joseph A.	Restoration of Carbon Dioxide Stores in Man after Acute Mechanically Induced Hyperventilation
1961	Malindzak, George S.	A Digital Computer Analysis of Some Transmission Live Characteristics of the Mammalian Arterial System
1962	Fife, William P.	The Fate of Radioiodine after Parental Administration

DOCTOR OF PHILOSOPHY DEGREE (continued)

Year	Name	Thesis Title
1962	Pratt, Alfred J.	The Demonstration of the Starling Mechanism of Cardiac Control in the Right Ventricle of the Intact, Anesthetized Dog
1962	Barth, Delbert S.	Equilibrium Approached by Alveolar Carbon Dioxide During Breath Holding
1962	Mandel, Morris J.	Effect of Angiotensin Infusion of Regional Blood Flow and Regional Vascular Resistance in Rat
1962	Roldan, Pura S.	Studies on the Effect of Quiuidine on Cardiovascular Hemodynamics and on Myocardial Mineral and Carbohydrate Metabolism
1962	Vogel, Thomas T.	Studies on the Mechanism of Hyperemia in Skeletal Muscle During Contraction
1963	Bricker, Jerome G.	The Effect of Hydrocortisone on Glutamic Dehydrogenases Activity in Rat Liver
1963	Mohammad, Syed F.	Some Relationships between Driving Point Pressure and Changes in Electrical Impedance of the Dog's Thigh
1963	Paul, Lawrence T.	Myocardial Relaxation: The Effect of Epinephrine on Unit Synchronization
1963	Arscott, Phyllis	The Blood Flow to Bone Marrow and Other Organs Following Varying Periods of Intermittent Hypoxia in the Rat
1963	West, Jan C.	The Influence of Past History upon the Nonlinear Passive Tensions Developed in Sinusoidally Extended Frog Skeletal Muscle
1965	Fleming, James S.	Renal Clearance Studies in Dogs during Pavlovian Conditioning
1965	Fox, Edward L.	Thermal Responses of Man During Rest and Moderate Exercise in Helim-Oxygen Environment

DOCTOR OF PHILOSOPHY DEGREE (continued)

Year	Name	Thesis Title
1966	Bowers, Richard W.	Effect of Two Hour Exposure to Helium-Oxygen of Resting O_2 Consumption
1966	Rhoades, Rodney A.	Metabolic Changes in Animals Maintained in a Helium-Oxygen Environment
1967	Early, Calvin B.	Dynamic Pressure-Flow Relationships of Brain Blood Flow in the Monkey
1967	Beckman, David L.	Surfactant, Pressure-Volume Curves, and Components of Lung Compliance in Rats: Effects of Exposure to One Atmosphere of Oxygen
1968	Beck, Ronald R.	Adrenal Steroids and their Relation to Survival in the Opossum
1968	Skelley, Dean S.	Effects of Estrogen -17 on Normal Human Ovarian Steroidgenesis
1968	Sparkman, Marjorie F.	Studies of the Adverse Effects of Oxygen at Atmospheric Pressure
1969	Baker, Houston R.	The Modification of Calcium Contractures of Frog Ventricle by Autonomic Drugs

Table 2

MASTER OF SCIENCE DEGREE

Year	Name
1923	Charlton, Paul H.
1924	Durrant, Rollin R.
1928	Ashcraft, Derwin W.
1929	Mattison, Alvin W.
1930	Kohn, Joseph W.
1930	Schiffer, Abe L.
1930	Manahan, Helen M.
1931	Madison, William J.
1932	Newman, Bernard M.
1932	Trotman, James R.
1933	Grubbs, Robert C.
1934	Simons, Arthur H.
1938	Lewis, Lena A.
1939	MacQuigg, David E.
1940	Griffiths, William J.
1940	Stauffer, Floyd R.
1944	Hermanson, Virginia
1947	Glass, Olin C.
1947	Stacy, Ralph W.
1947	Moore, Ilean
1948	Kemph, John P.
1948	Vail, Edwin G.
1949	Rosenbaum, Donald A.
1949	Baker, Saul P.
1949	Fusco, Madeline M.
1950	Frye, Sanders A.
1950	Kydd, George H. III
1950	DiPasquale, Edith L.
1950	Fasola, Alfred F.
1950	Murray, Mary C.
1950	Rodgers, John T.
1951	Kraner, James C.
1951	Pultz, Andrew J.
1952	Brown, John R.
1952	Frank, George B.
1952	Picklow, Francis E.
1952	Zatzman, Marvin L.
1953	McPherson, Richard C.
1954	Vidt, Donald G.
1954	Weil, William S.
1954	Mitchell, Walter G.
1954	Gannon, William J.
1955	Hepps, Sanford A.
1955	Leverett, Sidney D.
1955	Martin, Wanda Squires
1955	Hickey, Judson C.

MASTER OF SCIENCE DEGREE

Year	Name
1956	Weaver, Richard I.
1956	LeVora, Norman W.
1956	Yanof, Howard M.
1956	Woolley, Dorothy S.
1957	McFadden, Ernest
1958	Malindzak, George S.
1959	Jackson, Margaret M.
1959	Lipsky, Joseph A.
1959	West, Jan. C.
1960	Paul, Lawrence T.
1960	Vogel, Thomas T.
1960	Herrera, Freda M.
1960	Danforth, Nicholas
1960	Leitch, Gordon J.
1961	Plakornkul, Wattana
1962	Angelone, Alfonso
1962	Whateley, Dorothy E.
1963	Tarsitano, John J.
1963	Olejar, Michael
1964	Gould, Kenneth G.
1964	Scott, David E.
1964	Beckman, David L.
1964	Miller, David L.
1964	DeWein, Louis F.
1964	Wright, Ronald A.
1964	Austen, Burton G.
1965	Donley, Patrick J.
1965	Kunz, Albert L.
1965	Tyszka, Edward S.
1965	Porter, Leonard J.
1965	Folk, Roger M.
1966	Skelley, Dean S.
1967	Beck, Ronald R.
1967	Hollis, Theodore M.
1967	Wead, William B.
1967	Durkin, Edmund J.
1967	Porterfield, Susan P.
1967	Predmore, Philip D.
1968	Huang, Sue
1968	VonWyl, Harold R.
1968	Bowman, Jeffrey S.
1968	Holcomb, Archer C.
1968	Galich, John W.
1969	Garcia, Richard E.
1969	Gotshall, Robert W.

Table 3

RESEARCH GRANTS

Investigator	Project Title	Source of Support	Amount of funds
Dr. Angerer	Oxidative Metabolism of Renal Cortices with Experimental Athersoclerosis	N.I.H. General Research Support Grant	62,727.00
Dr. Bozler	Initiation of Activity in Smooth Muscle	HEW-PHS-NIH-Arthritis and Metabolic Diseases	$164,981.00
Dr. Brownell	Control of the Adrenal Cortex in the Opossum	National Science Foundation	28,300.00
	Control of the Adrenal Cortex in the Opossum	Institutional General Research	3,600.00
Dr. Grossie	Continued Research in the Field of Nerve Receptor Physiology	Institutional General Research	13,000.00
	Influence of Adrenal Hormones on Muscle Receptors	HEW-PHS-NIH Neurological Diseases and Blindness	13,850.00
Dr. Hanson	Intra-Hepatic Control of Arterial and Portal Inflow to the Liver	American Heart Association, Inc.	9,515.00
	Intra Hepatic Control of Liver Blood Flow	PHS-NIH-National Heart Institute	500.00
	Local Control of Hepatic Arterial and Portal Venous Blood Flow as Studied in a Completely ex-vivo Perfused Liver Preparation	Lucas Co. Br. of Northwestern Heart Assoc.	4,168.00
Dr. Hendrich	Animals and their Care--The Rate of Metabolism of Exogenous Gonadotrophins in the Rat and the Effects Mediated on this Rat by Thyroid and Parathyroid Hormones	R.L.Ireland Found.	1,000.00

Investigator	Project Title	Source of Support	Amount of funds
Dr. Hendrich	Endocrine Function in Proposed Spacecraft Atmospheres	Aerospace Med. Div., Brooks Air Force Base	28,020.00
Dr. Kunz	Open-Loop Analysis of the Carbon Dioxide Receptor Reflex	Office of Naval Research	27,470.00
Dr. LeBrie	Renal Lymph and Renal Function	PHS-NIH & National Heart Institute	68,421.00
Dr. Lessler	Radiation Effects on Ehrlich Ascites	American Cancer Society	3,105.00
	Subcellular Particle of Reticulocytes	PHS, NIH	20,560.00
Dr. Lipsky	CO_2 Transients Associated with Hyperventilation	PHS, NIH & National Heart Institute	107,696.00
Dr. Little	A Study of Stress Relaxation and Myocardial Contraction	COHA, NIH & General Research Support	24,226.25
Dr. Michal	Progesteron Feed back Sites in the Brain During Cycling of Gonadotrophine	General Research Support Grant	1,550.00
	The Role of the Limbic System of the Brain in the Regulation of Behavior	General Research Support Grant	6,000.00
Dr. Nishikawara	Factors Affecting Glutamic Dehydrogenase	PHS, NIH, Arthritis and Metabolic Diseases	82,618.00
Dr. Paul	A Study of Aortic Distensibility in Intact Dogs	Central Ohio Heart Assoc., Inc.	6,505.00

Investigator	Project Title	Source of Support	Amount of funds
Dr. Pieper	Hemodynamic Studies	PHS, HEW, NIH, National Heart Institute	69,980.00
	Integrated Study of the Coronary System in Intact Dogs	American Heart Assoc., Inc.	59,720.00
Dr. Smith	The Effect of pH on the Cardiac Output of Closed Chest Animals	NIH, General Research Support Grant	33,549.00
Dr. Sparkman	Studies of the Effects of Prolonged Breathing of Oxygen	Bremer Foundation	4,500.00
Dr. Weiss	Inert Gas Effects on Developmental Physiology	NASA	329,190.00
	Blood PO_2 Artery QO_2 Relationship and Atherosclerosis	PHS, NIH, Heart Institute	95,025.00

Table 4

Publications during the past decade numbered approximately:

1959	10
1960	7
1961	17
1962	17
1963	18
1964	22
1965	12
1966	8
1967	46
1968	14

VI. Biographies

DEPARTMENT OF PHYSIOLOGY

ALLISON, MORGAN L. — Oral Surgery
D.D.S., O.S.U. 1944; Asst. Prof. 1950--; Chief of Division of Oral Surgery, University Hospital, 1957--

ANGERER, CLIFFORD A. — General Physiology
A.B., Columbia U. 1929; Ph.D., U. of Pennsylvania 1937; Instr. 1939; Asst. Prof. 1943; Assoc. Prof. 1947; Prof. 1954--

BEMAN, FLOYD M. — see Department of Medicine

BILLINGS, CHARLES E. — see Department of Preventive Medicine

BIAIR, ALLEN E. — Oral Surgery
B.A., O.S.U. 1951; D.D.S., O.S.U. 1955; M.Sc., O.S.U. 1960; Instr. 1967--

BOZLER, EMIL — Physiology of Muscle
Ph.D., U. of Munich 1923; Asst. Prof. 1936; Assoc. Prof. 1942; Prof. 1946--

BROWNELL, KATHERINE A. — Endocrinology
B.A., U. of Buffalo 1925; M.A., U. of Buffalo 1930; Ph.D., O.S.U. 1940 Instr. 1946; Asst. Prof. 1953-1960; Assoc. Prof. 1960--

CALHOON, THOMAS B. — Molecular & Cardiovascular Physiology
B.A., O.S.U. 1948; Ph.D., O.S.U. 1952; Assoc. Prof. 1963-66; Prof. 1966-67.

CARTER, EARL T. — see Department of Medicine

CIANCY, RICHARD L. — Cardiovascular Physiology
B.A., U. of Minn. 1956; M.Sc., U. of Minn., 1961; Ph.D., U. of Kansas 1965; Asst. Prof. 1967-69.

COULTER, JR., NORMAN A. — Neurophysiology
B.S., Virginia Polytechnic Institute 1941; M.D., Harvard Medical School 1950; Asst. Prof. 1952-65.

GROSSIE, JAMES A. — Neurophysiology
B.S., Sam Houston State College 1960; M.A., Sam Houston State College 1960; Ph.D., U. of Missouri 1963; Asst. Prof. 1965--

GRUBBS, ROBERT C. — Metabolism
B.A., O.S.U. 1930; M.Sc., O.S.U. 1933; M.D., O.S.U. 1935; Asst. Prof. 1946; Assoc. Prof. 1948; Prof. 1957--; Asst. Prof. in Dept. of Medicine 1953--

HANSON, KENNETH M. — Cardiovascular Physiology
B.S., Sioux Falls College 1951; M.S., Indiana U. 1963; Ph.D., Indiana U. 1965; Asst. Prof. 1966--

HARTMAN, FRANK A. — Endocrinology
B.A., U. of Kansas 1905; M.A., U. of Kansas 1909; Ph.D., U. of Washington 1914; Prof. 1934-54; Chr. 1934-47; Emer. Research Prof. 1954--

HENDRICH, CHESTER E. — Endocrinology
A.B., U. of Missouri 1959; M.Sc., U. of Missouri 1961; Ph.D., U. of Missouri 1961; Asst. Prof. 1967--

FACULTY BIOGRAPHIES

HIATT, EDWIN P. — Environmental Physiology
A.B., Wilmington College 1933; M.A., Haverford College 1934; Ph.D., U. of Maryland 1940; M.D., Duke 1951; Prof. 1960--

HITCHCOCK, FRED A. — Physiology of Respiration
Ph.B., U. of Akron 1912; M.Sc., O.S.U. 1923; Ph.D., O.S.U. 1926; Instr. 1923; Asst. Prof. 1923; Assoc. Prof. 1936; Prof. 1944-1960; Acting Chr. 1947-49; Emeritus Prof. 1960--

HOLT, JOHN — Oral Surgery
D.D.S., O.S.U. 1960; Instr. 1968--

HULL, HUGH B. — see Department of Medicine

KING, BARRY G. — Industrial Physiology
A.B., U. of California 1924; M.A., U. of California 1925; Ph.D., Columbia Univ. 1934; Assoc. Prof. 1954-58.

KUNZ, ALBERT L. — Cardiovascular Physiology
A.B., Indiana U. 1956; M.D., Indiana U. 1959; M.S., O.S.U. 1965; Instr. 1962-63; Asst. Prof. 1965--

LEBRIE, STEPHEN J. — Renal Physiology
B.S., Long Island U. 1953; M.A., Princeton U. 1955; Ph.D., Princeton Univ. 1956; Assoc. Prof. 1966--

LESSLER, MILTON A. — Comparative Physiology
B.S., Cornell U. 1937; M.S., Cornell U. 1938; Ph.D., New York U. 1950; Asst. Prof. 1951; Assoc. Prof. 1957-63; Prof. 1963--

LIPETZ, LEO A. — see Department of Biophysics

LIPSKY, JOSEPH A. — Cardiovascular Physiology
B.S., Penn. State U. 1951; M.Sc., O.S.U. 1959; Ph.D., O.S.U. 1961; Asst. Prof. 1961-67; Asst. Prof. (Dentistry) 1967-68; Assoc. Prof. 1967--; Assoc. Prof. (Dentistry) 1968--

LITTLE, ROBERT C. — Cardiovascular Physiology
A.B., Denison U., 1942; M.D., Western Reserve 1944; M.S., Western Reserve 1948; Prof. and Chr., Dept. of Physiology 1964--

LUKIN, LARISSA — Cardiovascular Physiology
B.A., Katowice Coll., Poland; Cand. Med., Heidelberg, Germany 1949; Ph.D., Columbia U. 1955; Asst. Prof. 1957-63.

MATHEWS, DONALD K. — Department of Physical Education

MICHAEL, EDWIN K. — Neurophysiology
B.A., Kansas Wesleyan U. 1954; M.S., U. of Illinois 1962; Ph.D., U. of Illinois 1965; Asst. Prof. 1965--

MYERS, WILLIAM G. — Department of Radiology

NISHIKAWARA, MARGARET T. — Endocrinology
B.A., 1947, M.A., 1948, Ph.D., 1952, U. of Toronto; Asst. Prof. 1954-63; Assoc. Prof. 1963--

FACULTY BIOGRAPHIES

OGDEN, ERIC — Cardiovascular Physiology
B.Sc., University College, London 1925; M.R.C.S. (Eng.), L.R.C.P. (London) 1928; Prof. and Chr. 1949-63.

PAUL, LAWRENCE T. — Cardiovascular Physiology
B.S., Muhlenberg College 1955; M.Sc., O.S.U. 1960; Ph.D., O.S.U. 1963; Asst. Prof., O.S.U. 1965--

PIEPER, HEINZ P. — Cardiovascular Physiology
M.D., U. of Munich, Germany, 1948; Asst. Prof. 1958-60; Assoc. Prof. 1960-68; Prof. 1968--

SAPIRSTEIN, LEO.A. — Cardiovascular Physiology
B.S., Coll. of the City of New York 1937; M.A., U. of California 1940; Ph.D., U. of California 1943; M.D., U. of California 1946; Asst. Prof. 1951; Assoc. Prof. 1953; Prof. 1955-65; Asst. Prof. 1952-56 Dept. of Medicine

SMITH, CHARLES W. — Cardiovascular and Resp. Physiology
B.S., Wheaton College 1948; M.Sc., U. of Michigan 1949; M.S., U. of Michigan 1953; Ph.D., U. of Michigan 1955; Assoc. Prof. 1964--

SPARKMAN, MARJORIE F. — Respiratory Physiology
B.M., Florida State Coll. for Women 1945; M.R.E., Carver School of Missions and Social Work 1947; B.S., U. of Alabama 1961; M.Sc., O.S.U. 1962; Ph.D., O.S.U. 1968; Asst. Prof., O.S.U. 1968--

STACY, RALPH W. — Biophysics
B.Sc., Miami U. 1946; M.Sc., O.S.U. 1947; Ph.D., O.S.U. 1948; Asst. Prof. 1949; Assoc. Prof. 1953-63.

STOW, RICHARD W. — see Physical Medicine

TOMASHEFSKI, JOSEPH F. — see Department of Medicine

WEISS, HAROLD S. — Environmental Physiology
B.S., Rutgers 1946; M.Sc., Rutgers 1949; Ph.D., Rutgers 1950; Assoc. Prof. 1963-67; Prof. 1967--

YAPLE, NEWELL H. — Oral Surgery
D.D.S., O.S.U. 1957; Instr. Physiology 1966--